Appendix AD

Elimatta Project Air Quality and Greenhouse Gas Assessment

Northern Energy Corporation Limited

AustralAsian Resource Consultants

Elimatta Coal Mine

Wandoan, Queensland

Air Quality & Greenhouse Gas Assessment

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Prepared for

AustralAsian Resource Consultants

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1 Introduction

ASK Consulting Engineers was commissioned by AARC on behalf of Taroom Coal Pty Ltd to carry out an air quality impact and greenhouse gas assessment for the construction and operation of the proposed Elimatta Coal Mine.

The proposed operation is located approximately 35km west of the township of Wandoan, as shown on Figure 1.1. The West Surat Rail link from the mine to the Surat Basin Railway and all associated factors will be addressed in a separate report.

The purpose of this report is as follows:

- Present background air pollutant level data provided to ASK.
- Determine appropriate air quality criteria for the project.
- Determine the air pollutant emission levels of the proposed fixed and mobile plant.
- Assess operational and construction air pollutant levels in accordance with the relevant air quality criteria.
- Assess cumulative impacts from Elimatta and other mine/s.
- Prepare greenhouse gas inventory.
- Provide recommendations for inclusion in the Environmental Management Plan.

This report has been amended following comments received from Department of Environment and Heritage Protection (EHP). A summary of those comments is provided in Table 1.1 along with a cross-reference to the sections of this report that have been amended to address each issue.

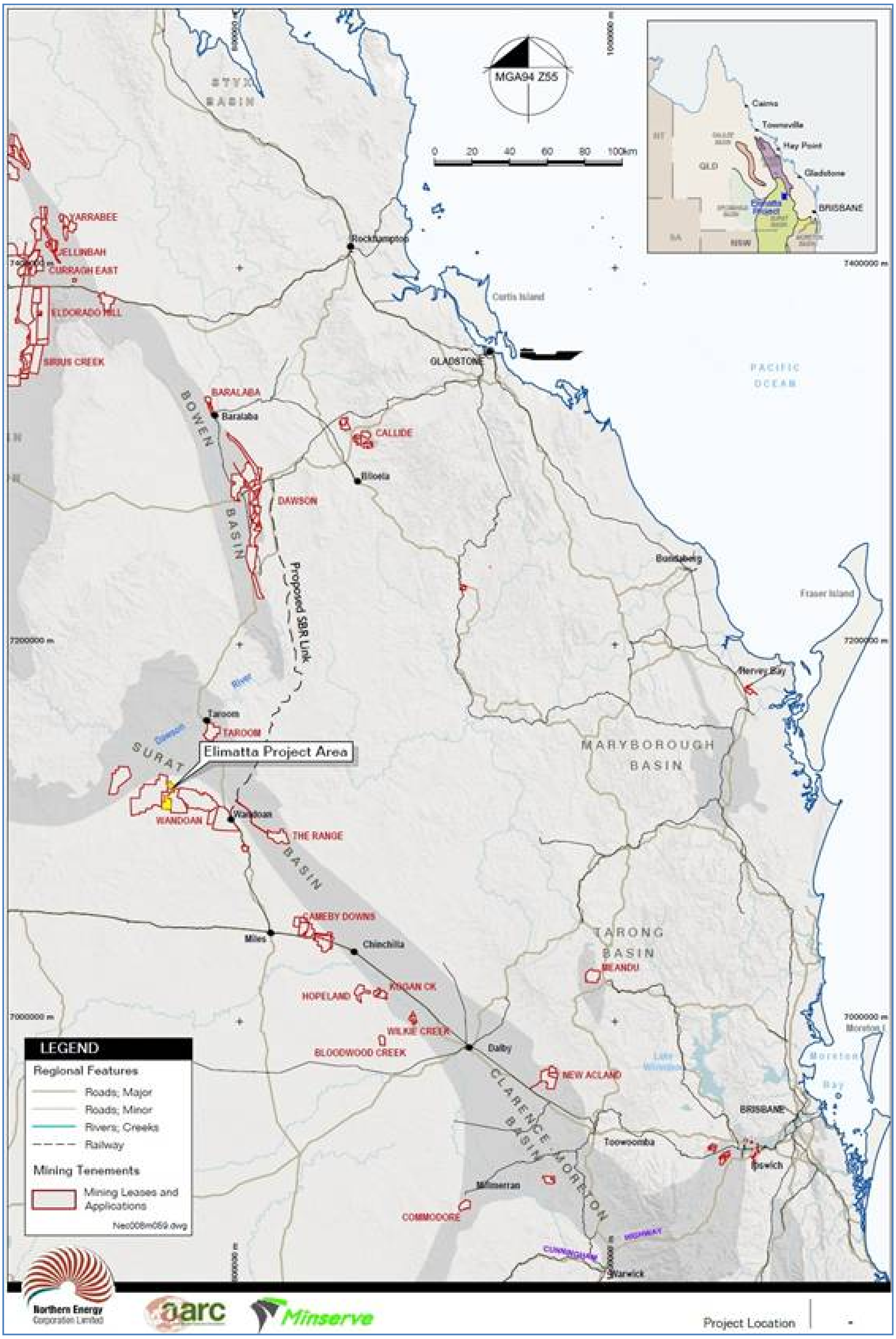

Figure 1.1 Location of Elimatta Mine

Table 1.1 Summary of Comments and Responses

Stakeholder	Summary of Comment	Brief Response	Sections Discussed
EHP	The report should confirm that dust emissions from the CHPP and associated activities have been included in the modelling emission inventory.	Process description has been updated. Confirmed that plant activities modeled include coal processing, reclaimer and rail loadout. Stacker emissions have also been added to the report tables. Need for of sprays on ROM stockpiles included.	Section 2.1 Section 5.2 Section 9
EHP	Dust deposition data and source literature reviewed should be summarised and included as a table in the assessment report.	Data has not been published. More detail and justification is provided.	Section 4.1.2
EHP	The EIS should clarify whether the dust levels shown in Table 6.1 are inclusive or exclusive of assumed background concentrations	The last sentence before Table 6.3 has been clarified.	Section 6.1.5
EHP	That table titles and figure captions be revised to include a clear statement regarding the inclusion or exclusion of assumed background dust concentrations/deposition rates.	Clarified table and figure headings.	Table 6.1, Tables in Appendix E, Figures in Appendix F.
EHP	Reference in the report should be carefully reviewed and a recognized referencing style be adopted throughout.	Updated referencing throughout and reference list.	Multiple
EHP	Inconsistency in coal production rates.	Rates clarified.	Sections 2.1 and 8.2
EHP	Incorrect $PM_{2.5}$ concentration in text.	Corrected	Section 6.1.1
EHP	Figure B.1 title incorrect.	Corrected.	Figure B.1

2 Project Description

2.1 Project Description

Taroom Coal Pty Ltd wishes to mine the Elimatta coal deposit in central Queensland, approximately 35 kilometres west of Wandoan.

The proposed maximum annual Run of Mine (ROM) coal processed is 8.2 Mt of coal. Based on a current assessment of the available resource, the expected production life of the Project is in excess of 32 years. Including construction through to decommissioning and shutdown, the whole of project life is near to 40 years.

Mining and crushing will operate 7 days a week, 24 hours a day at peak production. Mining will be open pit using conventional truck and excavator methodology. The initial proposed project infrastructure for years 1, 10 and 20 are shown in Appendix A. All drawings have been provided by The Minserve Group Pty Ltd c/- AARC. As the coal mine covers an area of 2,775 hectares (ha) the impact of the changes in the site layout would be significant with respect to the predicted air quality levels at the nominated sensitive receivers. Therefore a range of scenarios will be used to evaluate the air quality impact from the mining site.

Excavators will load material from the pits into dump trucks for transport to the ROM stockpiles. Hauling from the pits to the waste and ROM stockpiles will be conducted using dump trucks. ROM coal transported from the pit area will be directly dumped into a 500 tonne ROM hopper at the coal handling and processing plant (CHPP) or stockpiled in 3 x 20,000 tonne dumps depending on CHPP availability. The ROM bin has been designed to accept rear dumping from CAT 793 trucks and complementary feeding by CAT 994 FEL on the adjacent side. To enable the recovery of the product coal from the stockpiles for train loading, one coal valve will be located under the discharge of each of the product stacking conveyors.

Service vehicles and water trucks will operate on the haul roads. All these sources are included in the model.

The onsite operation can be described as:

- Mining 24 hours a day.
- Crushing 24 hours a day.
- Base fleet.

Blasting will be required and is to be carried out on a regular basis with the following typical characteristics for each blast:

- Blast area of 50,000m^2 with 64 holes.
- Blast hole width of 0.250m and a maximum depth of 10m.
- Stemming Height of 5.0-6.0m.
- MIC 500 kg.

2.2 Sensitive Locations

The nearest 54 sensitive locations are summarised in Table B.1 in Appendix B including the northing and easting locations. A figure showing the receiver locations is included in Figure B.1 in Appendix B. The closest receiver is approximately 1000m away from the mining operation.

3 Air Quality Environmental Values

The proposed mining operations will result in the emission of a number of classes of particulate matter namely total suspended particulate matter (TSP), particulate matter with equivalent aerodynamic diameters of 10 µm or less (PM_{10}), and particles with equivalent aerodynamic diameters of 2.5 µm and less ($PM_{2.5}$). These emissions would occur primarily as fugitive dust from open cut mining operations.

There will also be exhaust emissions from diesel powered haul trucks and other open cut mining equipment. These emissions will include carbon monoxide (CO), minor quantities of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), Volatile Organic Carbons (VOC) and PM_{10}. In practice, the gaseous emissions will be minor and are not considered further. As such the project's potential to generate photochemical smog and acid rain would also be minor and are not considered further. Particulate matter emissions from the exhausts of diesel powered mining equipment are included within the assessment of dust emissions as they are part of the fugitive emissions calculations.

The focus of the assessment will be on potential impacts due to emissions of particulate matter.

The air quality assessment has been undertaken with reference to air quality limits specified in the Environmental Protection (Air) Policy 2008 (EPP(Air)) and NSW Department of Environment and Conservation (DEC) criteria have been summarised in Table 3.1. The relevant air quality indicators for particulate emissions are shown. The EPP(Air) has incorporated the particulate matter goals nominated within the National Environmental Protection Measure (NEPM).

Dust deposition limits are based on acceptable dust fallout values, in relation to nuisance, and are expressed in terms of g/m^2/month.

Table 3.1 Air Quality Criteria

Air Quality Indicator	Units	Design Ground Level	Averaging Period	Source	Allowable Exceedances
Particulate $PM_{2.5}$	µg/m^3	25	24 hours	EPP(Air)	-
		8	1 year		-
Particulate PM_{10}	µg/m^3	50	24 hours	EPP(Air)	5 days each year
Total Suspended Particulate (TSP)	µg/m^3	90	1 year	EPP(Air)	-
Particles (deposited)	g/m^2/month	4	30 days	DEC (2005)	-

4 Existing Environment

It is expected that the air quality for the study area would be reasonably good, with acceptable levels of pollutants for the majority of the time. The existing air quality for the subject area would be influenced by sporadic traffic on unsealed roads as well as bushfires and controlled burning. Localised or short-term degradation of the air quality environment would most likely be due to smoke and dust from bushfires.

Background pollutant levels were based on available previous Queensland studies. These background pollutant levels are considered to be a reasonable estimate of the existing air quality in the study area.

Meteorology for the site has been simulated using TAPM (Hurley 2008), a model developed by CSIRO Division of Atmospheric Research in Australia, which incorporates 3-dimensional prognostic spatial and temporal meteorological prediction.

4.1 Existing Air Quality

4.1.1 Dust Concentration

As the majority of the project sensitive receivers are within a rural environment, background dust concentration data relating to typical rural environments are considered appropriate. Dust monitoring in the area has been conducted for dust deposition only with no dust concentration data available. The Department of Environment and Resource Management (DERM) operates an air pollutant monitoring network within Queensland, however the majority of locations are within highly populated areas (DERM, 2010) with extensive traffic. Therefore these values are not considered appropriate for a rural site but would represent a maximum for the range of typical dust concentrations within the project area. Based on the DERM monitoring an assumed 24 hour average and annual average background PM_{10} concentrations of 20 $\mu g/m^3$ and 10 $\mu g/m^3$ have been utilised for the project area.

Based on a typical ratio of PM_{10} to TSP around Australian mines being 0.39 (ACARP, 1999), a ratio of 0.4 has been used to estimate the annual average TSP concentration, being 25 $\mu g/m^3$. A $PM_{2.5}$ to PM_{10} ratio of 0.25 has been used to determine background $PM_{2.5}$ concentrations. Based on the assumed PM_{10} values, the 24 hour and annual average background $PM_{2.5}$ concentrations have been estimated to be 5 $\mu g/m^3$ and 3 $\mu g/m^3$ respectively.

4.1.2 Dust Deposition

No dust deposition data is available for the nearest sensitive receivers in the vicinity of the proposed mine, however ASK has unpublished confidential results of dust deposition monitoring undertaken for other client mining companies at similar locations in central Queensland such as Dysart and Charters Towers. The average dust deposition from monitoring at these locations was 33 $mg/m^2/day$. This is likely to be also typical of annual average dust fallout in the Darling Downs region whilst higher levels may exist in the vicinity of local sources. Therefore, to be conservative, the average background deposition rate for this study has been assumed to be double the nominated monitoring results, that is 2.0 $g/m^2/month$ (67 $mg/m^2/day$). This is consistent with the methodology and criteria for deposited dust specified by the NSW Department of Environment and Conservation (2005), which specifies criteria of 2 g/m^2/month without background and 4 g/m^2/month including background.

4.2 Meteorology Simulation

Currently no measured site specific data exists for the subject mine, therefore the meteorological component of The Air Pollution Model (TAPM) was used to simulate local wind data for the site.

The databases required to run TAPM are provided by CSIRO and include global and Australian terrain height data, vegetation and soil type datasets, sea surface temperature datasets and synoptic scale meteorological datasets.

The global terrain and land characterisation data is in the form of 30-second grid spacing (approximately 1 km) and is based on public domain data available from the US Geological Survey, Earth Resources Observation Systems (EROS) Data Centre Distributed Active Archive Centre (EDC DAAC). The Australian terrain data is in the form of 9-second grid spacing (approximately 0.3 km) and is based on licensed data available from Geoscience Australia. Australian vegetation and soil type data is on a longitude/latitude grid at 3-minute grid spacing (approximately 5 km) and is public domain data provided by CSIRO Wildlife and Ecology.

The sea surface temperature dataset is based on Rand's global long-term monthly mean sea surface temperatures on a longitude/latitude grid at 1-degree grid spacing (approximately 100 km). They are based on public domain information available from the US National Center for Atmospheric Research (NCAR).

The synoptic scale meteorology datasets used are a six-hourly synoptic scale analyses on a longitude/latitude grid at 0.75 or 1.0-degree grid spacing (approximately 75 km or 100 km). The database is derived from GASP analysis data from the Bureau of Meteorology (BoM).

TAPM dynamically fits the gridded data for the selected region to finer grids taking into account terrain, surface type and surface moisture conditions. TAPM produces detailed fields of hourly estimated temperature, winds, pressure, turbulence, cloud cover and humidity at various levels in the atmosphere as well as surface solar radiation and rainfall.

Seasonal wind rose diagrams based on the TAPM predictions are presented in Appendix C.

They indicate the following:

- Highest speeds are normally associated with winds during the 12:00 – 18:00 time period.
- During the night and early morning the wind speed decreases resulting in a large percentage of the lower wind speeds.
- Winds are predominantly from the northeastern quadrant and south.
- In summer, winds are predominately from the northeastern quadrant and south.
- In autumn, winds are mainly from the northeastern quadrant.
- In winter, winds are mainly from the south and east.
- In spring, winds are mainly from the east.
- Winds during the morning are predominantly from the northeast and south.
- Winds during the afternoon are predominantly from the east and north.

Plume dispersion is affected by atmospheric stability. Plumes are more readily dispersed during unstable atmospheric conditions, such as on a hot summer's day, than during stable atmospheric conditions, such as on a cool winter's night. Very unstable conditions are denoted as Stability Class A, with very stable conditions denoted as Stability Class F. Neutral conditions, such as those that typically occur during cloudy conditions, are denoted as Stability Class D.

A graph of Stability Class TAPM predictions is also presented in Appendix C. The stability data is presented as a frequency distribution for a full year. It can be seen that stability classes F (very stable) and D (neutral) are dominant with frequencies of 35.7% and 21.2% respectively. Unstable conditions being Class B result in 16.9% of the distribution while unstable Classes A, B and E results in the remainder of the distribution for the year.

5 Air Quality Modelling

5.1 Methodology

The dust predictions undertaken for this assessment are based on the following:

- Dust emissions estimates were based on accepted methods and data consolidated by the National Pollutant Inventory (NPI) (Environment Australia 1999, 2011) and the United States Environmental Protection Agency (USEPA 1999) shown in Appendix D.
- Prediction of input meteorology using TAPM developed by the CSIRO Division of Atmospheric Research. TAPM has a prognostic three dimensional meteorological component which can be used to generate hourly meteorological data for input into Gaussian plume models.
- Prediction of dust concentrations and depositions with CALPUFF (Scire et al 2000) developed by Earth Tech.
- Predicted levels are compared against criteria presented in Section 3.

CALPUFF is a model which is accepted by the DERM for regulatory applications. Predictive models of airborne pollutant dispersion are simplifications of reality. The CALPUFF model provides useful and adequate indications of ground level concentrations for most practical purposes.

TAPM is a prognostic three-dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. TAPM uses synoptic, terrain and surface characteristics (temperature, vegetation and moisture content) to predict meteorology. Nested grids are used within a large domain, this allows the meteorological resolution to be refined to a local scale. TAPM predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows. These fields can then be used to produce the ISC meteorological files that are utilised in the CALPUFF dispersion model, as was done for this study.

Four scenarios have been used to assess the maximum air pollutant impacts on the surrounding sensitive receivers being Years 2, 10, 20 and 27 of mining operations.

Coal trains would enter the site via a rail loop and be loaded by a front end loader adjacent to the plant. Dump trucks would transfer the ROM material to the stockpiles and waste to waste dumps. Excavators would load material from the pits into dump trucks for transport to the stockpiles. Front end loaders would be operating at the processing area to load the material into the processing plant. Associated pieces of equipment such as drills would also be operating at the face. Service vehicles and water trucks would operate on the haul roads. These sources were included in the model.

5.2 Dust Emission Sources and Controls

The project's operations have been characterised into the main particulate generating activities allowing for the estimation of dust emissions to be undertaken. A particulate emissions summary of the main dust generating activities used as input into the CALPUFF dispersion model for each modelled year is presented in Tables 5.1 to 5.4. Plant activities consist of three sources of particulate emissions: coal processing, reclaimer and rail loadout. Tables 5.1 to 5.4 do not include the dust emission control factors.

Table 5.1 Mining Dust Emissions Year 2 (No Control Technology)

Activity	TSP Emissions (kg/yr)	PM10 Emissions (kg/yr)	PM2.5 Emissions (kg/yr)
Loading to trucks with Overburden	31,887	15,082	1,056
Loading to trucks with Coal	152,633	72,191	8,663
Bulldozing Coal	352,237	111,800	13,416
Bulldozers on Overburden	60,188	12,010	6,365
Truck Unloading Overburden	15,943	7,541	3,167
Truck Unloading Coal	2,180	1,031	52
Drilling	2,643	1,389	83
Blasting	111,295	57,873	3,472
Wheel Dust Generation from Unpaved Roads	1,878,637	514,839	51,484
Use of Grader	94,185	29,784	4,170
Plant Activities	24,140	9,585	1,438
Stacker	2,180	1,031	62
Wind Erosion From Stockpiles	48,391	24,195	1,210
Total	2,776,540	858,352	94,638

Note: Totals may be different to the sum of the numbers presented due to rounding off.

Table 5.2 Mining Dust Emissions Year 10 (No Control Technology)

Activity	TSP Emissions (kg/yr)	PM10 Emissions (kg/yr)	PM2.5 Emissions (kg/yr)
Loading to trucks with Overburden	32,968	15,593	1,091
Loading to trucks with Coal	159,083	75,242	9,029
Bulldozing Coal	352,237	111,800	13,416
Bulldozers on Overburden	60,188	12,010	6,365
Truck Unloading Overburden	16,484	7,796	3,274
Truck Unloading Coal	2,272	1,075	54
Drilling	2,643	1,389	83
Blasting	111,295	57,873	3,472
Wheel Dust Generation from Unpaved Roads	1,947,527	533,719	53,372
Use of Grader	94,185	29,784	4,170
Plant Activities	25,160	9,990	1,499
Stacker	2,272	1,075	64
Wind Erosion From Stockpiles	48,391	24,195	1,210
Total	2,854,705	881,541	97,100

Note: Totals may be different to the sum of the numbers presented due to rounding off.

Table 5.3 Mining Dust Emissions Year 20 (No Control Technology)

Activity	TSP Emissions (kg/yr)	PM10 Emissions (kg/yr)	PM2.5 Emissions (kg/yr)
Loading to trucks with Overburden	82,284	38,918	2,724
Loading to trucks with Coal	176,281	83,376	10,005
Bulldozing Coal	352,237	111,800	13,416
Bulldozers on Overburden	60,188	12,010	6,365
Truck Unloading Overburden	41,142	19,459	8,173
Truck Unloading Coal	2,518	1,191	60
Drilling	2,643	1,389	83
Blasting	111,295	57,873	3,472
Wheel Dust Generation from Unpaved Roads	3,093,333	847,726	84,773
Use of Grader	94,185	29,784	4,170
Plant Activities	27,880	11,070	1,661
Stacker	2,518	1,191	71
Wind Erosion From Stockpiles	48,391	24,195	1,210
Total	4,094,895	1,239,983	136,183

Note: Totals may be different to the sum of the numbers presented due to rounding off.

Table 5.4 Mining Dust Emissions Year 27 (No Control Technology)

Activity	TSP Emissions (kg/yr)	PM10 Emissions (kg/yr)	PM2.5 Emissions (kg/yr)
Loading to trucks with Overburden	76,339	36,106	2,527
Loading to trucks with Coal	180,580	85,410	10,249
Bulldozing Coal	352,237	111,800	13,416
Bulldozers on Overburden	60,188	12,010	6,365
Truck Unloading Overburden	38,170	18,053	7,582
Truck Unloading Coal	2,579	1,220	61
Drilling	2,643	1,389	83
Blasting	111,295	57,873	3,472
Wheel Dust Generation from Unpaved Roads	3,603,234	987,464	98,746
Use of Grader	94,185	29,784	4,170
Plant Activities	28,560	11,340	1,701
Stacker	2,579	1,220	73
Wind Erosion From Stockpiles	48,391	24,195	1,210
Total	4,600,981	1,377,865	149,657

Note: Totals may be different to the sum of the numbers presented due to rounding off.

Table 5.5 lists the dust suppression techniques/controls to be utilised to reduce particulate emissions, as well as the estimated percentage reduction in dust emissions. It is assumed that most ROM coal will be dumped directly into the hopper, and sprays on the ROM stockpiles will substantially reduce dust emissions from the occasional loading from ROM stockpile to the hopper.

Table 5.5 Mining Dust Emission Controls (Environment Australia, 2011)

Emission Source	Control(s) Utilised	Control Efficiency Applied
Loading to trucks with Overburden	No control Utilised	0%
Loading to trucks with Coal	No control Utilised	0%
Bulldozing Coal	No control Utilised	0%
Bulldozers on Overburden	No control Utilised	0%
Truck Unloading Overburden	No control Utilised	0%
Truck Unloading Coal	No control Utilised	0%
Drilling	No control Utilised	0%
Blasting	No control Utilised	0%
Wheel Dust Generation from Unpaved Roads	Watering roads at >2L/m^2/hour	75%
Use of Grader	No control Utilised	0%
Front end loaders into ROM hopper	Stockpiled coal pre-sprayed	70%
Plant Activities	No control Utilised	0%

In addition to Table 5.5, pit retention factors of 50% for TSP and 5% for PM_{10} were utilised for activities located within the pit. These factors are specified by Environment Australia (2012).

6 Air Quality Assessment

The modelling of dust impacts was based on Years 2, 10, 20 and 27 of mining as the potential for impacts onto the surrounding sensitive receivers would be highest during the operations at these times.

6.1 Impacts at Sensitive Receptors

To represent the worst case scenarios the maximum predicted dust concentrations and depositions at the nearest sensitive receptors for the four modelled mining cases are shown in Table 6.1. A breakdown of the predicted dust concentrations and depositions for Years 2, 10, 20 and 27 are shown in Appendix E. For a cumulative assessment against the project air quality criteria the predicted levels include the assumed background levels for dust concentration (TSP, PM_{10} and $PM_{2.5}$) and deposition as outlined in Section 4.

The predicted regional results of the CALPUFF dispersion modelling for the project are presented as dust contour plots in Appendix F. The dust contours show the predicted dust concentrations for production years 2, 10, 20 and 27. The predicted dust contours are to visually show the predicted regional influence of the proposed mining operation and do not include the assumed background levels identified in Section 4.

The annual average concentrations are the average of 8760 one hour concentrations, the monthly average concentrations are the average of 720 one hour concentrations while the 24 hour concentration is the 24-hour midnight to midnight concentration. Maximum 24hr averaged concentrations are generally experienced under adverse meteorological conditions when mixing height is reduced due to a winter inversion. Results which exceed the nominated criteria are **bolded** in Table 6.1.

Table 6.1 Worst Case Predicted Dust Levels Including Background

Location	TSP Annual Average Concentration (µg/m³)	PM_{10} 24h Average Concentration (µg/m³)		$PM_{2.5}$ Concentrations (µg/m³)		Monthly Dust Deposition (g/m²/month)
		Maximum	6th Highest	Annual Average	24h Average	
Criterion	90	--	50	8	25	4
1	36.6	93.2	64.8	3.7	14.5	2.6
3	34.4	49.2	39.3	3.6	9.0	2.3
4	27.1	40.6	28.6	3.1	8.7	2.1
5	32.9	44.5	35.5	3.5	8.7	2.3
6	53.2	74.4	57.8	4.4	13.5	2.8
7	38.0	191.0	62.5	3.6	25.8	2.5
9	25.8	29.6	25.3	3.1	6.7	2.0
10	25.5	28.2	22.7	3.0	6.3	2.0
12	25.4	25.3	22.1	3.0	5.8	2.0

Location	TSP Annual Average Concentration (µg/m³)	PM10 24h Average Concentration (µg/m³)		PM2.5 Concentrations (µg/m³)		Monthly Dust Deposition (g/m²/month)
		Maximum	6th Highest	Annual Average	24h Average	
Criterion	90	--	50	8	25	4
13	25.2	23.0	21.7	3.0	5.6	2.0
14	25.2	22.9	21.1	3.0	5.5	2.0
15	25.2	22.8	20.9	3.0	5.5	2.0
16	25.1	22.7	20.8	3.0	5.5	2.0
17	25.1	23.2	20.9	3.0	5.6	2.0
18	25.1	22.6	20.7	3.0	5.5	2.0
19	25.1	22.8	20.8	3.0	5.5	2.0
20	25.1	22.2	20.8	3.0	5.4	2.0
21	25.1	22.3	20.5	3.0	5.4	2.0
23	25.1	22.0	20.4	3.0	5.4	2.0
25	25.1	21.5	20.5	3.0	5.3	2.0
26	25.1	21.9	20.4	3.0	5.4	2.0
27	25.1	21.8	20.4	3.0	5.3	2.0
28	25.1	21.5	20.4	3.0	5.3	2.0
29	25.1	21.4	20.3	3.0	5.3	2.0
30	25.0	21.2	20.3	3.0	5.2	2.0
31	25.0	21.0	20.2	3.0	5.2	2.0
32	25.0	20.7	20.2	3.0	5.1	2.0
33	25.0	21.1	20.3	3.0	5.2	2.0
35	27.0	30.6	26.8	3.1	6.6	2.1
36	26.8	29.7	26.6	3.1	6.5	2.1
37	25.2	22.7	20.9	3.0	5.5	2.0
38	25.2	22.6	20.9	3.0	5.5	2.0
39	26.0	38.3	28.2	3.1	7.9	2.0
40	32.0	54.0	45.2	3.5	10.2	2.3
41	31.7	39.1	34.5	3.4	7.6	2.2
42	25.0	21.0	20.2	3.0	5.2	2.0
43	25.0	21.0	20.2	3.0	5.2	2.0
44	25.1	21.6	20.4	3.0	5.3	2.0
45	25.1	22.7	20.5	3.0	5.5	2.0
46	25.7	29.1	24.3	3.0	6.7	2.0

Location	TSP Annual Average Concentration ($\mu g/m^3$)	PM_{10} 24h Average Concentration ($\mu g/m^3$)		$PM_{2.5}$ Concentrations ($\mu g/m^3$)		Monthly Dust Deposition (g/m^2/month)
		Maximum	6th Highest	Annual Average	24h Average	
Criterion	90	--	50	8	25	4
47	25.6	36.0	24.0	3.0	7.4	2.0
48	25.3	24.6	21.9	3.0	5.6	2.0
49	25.3	24.0	22.0	3.0	5.6	2.0
50	26.4	26.4	24.4	3.1	6.2	2.0
51	27.4	29.0	26.7	3.2	6.5	2.1
52	27.5	29.5	26.6	3.2	6.5	2.1
53	26.4	25.5	24.0	3.1	5.9	2.1
54	26.8	27.4	25.5	3.1	6.2	2.1
55	25.7	26.4	23.2	3.0	5.9	2.0
56	25.6	28.5	23.3	3.0	6.4	2.0
57	25.4	27.1	22.7	3.0	6.2	2.0
58	26.1	37.6	28.2	3.1	7.9	2.0
59	27.3	54.4	34.3	3.1	9.9	2.1
60	28.3	44.8	37.7	3.2	9.1	2.2

6.1.1 PM2.5

The predicted annual average $PM_{2.5}$ concentrations are below the EPP(Air) guideline value of 8 $\mu g/m^3$ for all locations during all modelled years (refer to Table 6.1 and Appendix E) .

The predicted maximum annual average $PM_{2.5}$ concentration is 4.4 $\mu g/m^3$, which occurs at Location 6 during year 2.

The predicted highest $PM_{2.5}$ 24-hour concentrations are below the EPP(Air) guideline value of 25 $\mu g/m^3$ for all locations during all modelled years (refer to Table 6.1 and Appendix E) except at Location 7 during years 20 and 27.

The highest predicted $PM_{2.5}$ 24-hour concentration is 25.8 $\mu g/m^3$, which occurs at Location 7 during year 27.

6.1.2 PM10

The predicted 6th highest 24hr average PM_{10} concentrations are below the EPP(Air) guideline value of 50 $\mu g/m^3$ for all locations during all modelled years (refer to Table 6.1 and Appendix E) except at Locations 6 and 7 during all modelled years and Location 1 during year 27.

The predicted maximum 6th highest 24hr average PM_{10} concentration is 64.8 μg/m^3, which occurs at Location 1 during year 27 operations.

6.1.3 TSP

The predicted annual average TSP concentrations are below the EPP(Air) guideline value of 90 μg/m^3 for all locations during all modelled years (refer to Table 6.1 and Appendix E) .

The predicted maximum annual average TSP concentration is 53.2 μg/m^3, which occurs at Location 6 during year 27.

6.1.4 Dust Deposition

The predicted monthly dust deposition rates are below the EPP(Air) guideline value of 4 g/m^2/month for all locations during all modelled years (refer to Table 6.1 and Appendix E) .

The predicted maximum monthly dust deposition rate is 2.8 g/m^2/month, which occurs at Location 6 during year 2.

6.1.5 Cumulative Impacts

Due to the proximity of Elimatta to other coal mines, the cumulative impact of all mines needs to be assessed to demonstrate compliance at all sensitive receiver significantly affected by the Project.

Wandoan Coal Mine is approved to be located immediately east of the Elimatta mine and therefore has been considered. There are also two underground coal mines (Bundi and Norwood) which are proposed, however they EIS reports have not been lodged and accepted, and therefore they have not been considered.

Wandoan Coal Mine is planned to be located immediately east of the Elimatta mine and therefore has been considered. There are also two underground coal mines (Bundi and Norwood) which are proposed, however they had not lodged an EIS at the time of this EIS and therefore have not been considered. The Wandoan Coal Mine EIS report being reviewed for this cumulative impacts assessment is the "Air quality assessment of the proposed Wandoan Coal Mine" Dated November 2008 – Final by Katestone Environmental Pty Ltd (Katestone 2008).

The properties that have been identified as assessed in the Wandoan assessment and potentially adversely impacted by Elimatta (taken as maximum TSP annual average contribution from Elimatta of 1.0 μg/m^3 or above) are:

- Lot 38 on AB188 (labelled Location 4 in this report).
- Lot 131 & 132 on SP121742 (labelled Location 7 in this report).
- Lot 45 on FT426, Lot 46 FT64, Lot 37, 44 FT67 (labelled Location 35 in this report).
- Lot 45 on FT426, Lot 46 FT64, Lot 37, 44 FT67 (labelled Location 36 in this report).
- Lot 34 on SP106737 (labelled Location 39 in this report).
- Lot 34 SP106737 (labelled Location 58 in this report).

The air quality criteria discussed in Section 3 is a mixture of short term (24 hour averaging periods) air quality impacts and long term (monthly and annual averaging periods) air quality impacts. Short term air quality impacts would predominantly be associated with adverse weather conditions, such as being downwind of the mine on a winter's night, when the dispersive capacity of the atmosphere is limited. The dominant wind direction required for the six nominated cumulative sensitive receivers to be downwind of Elimatta or Wandoan are shown in Table 6.2.

Table 6.2 Required Dominant Wind Direction for Receiver to be Downwind

Location	Elimatta	Wandoan
4	East to West	West to East
7	Southwest to Northeast	Southeast to Northwest
35	Southwest to Northeast	Southeast to Northwest
36	Southwest to Northeast	Southeast to Northwest
39	Northwest to Southeast	West to East
58	Northwest to Southeast	West to East

As shown in Table 6.2 the required dominant wind direction to experience short term air quality impacts form Wandoan and Elimatta is different for all six locations. Short term air quality impacts from both Elimatta and Wandoan occurring in the same 24 hour period is therefore unlikely and not been considered any further as a potential cumulative impact.

Long term air quality impacts are associated with annual and monthly meteorological patterns where both Elimatta and Wandoan may contribute to the potential air quality impacts experienced at the six sensitive receivers identified above. The long term air quality impacts assessed in both the Elimatta and Wandoan assessments are TSP annual average concentrations and monthly dust deposition rates. Table 6.3 shows at each location the predicted long term air quality impacts contributions for Elimatta and Wandoan and also the predicted cumulative impact from Elimatta, Wandoan and the existing background, as described in Section 4. The six cumulative impact sites are worst affected in Year 10 of the Wandoan EIS. Therefore predicted long term air quality impacts from Wandoan EIS are estimated off the Year 10 contour figures in Katestone 2008. The predicted long term air quality impacts from Elimatta, listed in Table 6.3, are the maximum impacts shown in Table 6.1 but with background removed.

Table 6.3 Cumulative Impacts onto Shared Sensitive Receivers

Location	TSP Annual Average Concentration ($\mu g/m^3$)			Monthly Dust Deposition ($g/m^2/month$)		
	Elimatta	Wandoan (Estimated from Figure 57 Katestone 2008)	Cumulative (including background)	Elimatta	Wandoan* (Estimated from Figure 59 Katestone 2008)	Cumulative (including background)
Criterion	-	-	90.0	-	-	4.0
4	2.1	<15	42.1	0.1	<0.9	3.0
7	13.0	<15	53.0	0.5	<0.9	3.4
35	2.0	<15	42.0	0.1	<0.9	3.0
36	1.8	<15	41.8	0.1	<0.9	3.0
39	1.0	<15	41.0	0.0	<0.9	2.9
58	1.1	<15	41.1	0.0	<0.9	2.9
Estimated Background	-	-	25.0	-	-	2.0

Note * The Wandoan assessment provide dust deposition rates as $mg/m^2/day$. The Wandoan dust deposition rates have been divided by 33.3, as per AS/NZS 3580.10.0:2003 to provide results as $g/m^2/month$.

Table 6.3 shows that cumulative impacts of both Elimatta and Wandoan meet the air quality environmental values described in **Section 3**.

6.2 Discussion

The air pollutant impacts from the proposed Elimatta mine were assessed against typical DERM (now EHP) dust deposition guidelines and Environmental Protection (Air) Policy 2008 goals. Predictions of TSP, PM_{10} and $PM_{2.5}$ are presented in **Section 6.1** and assessed against the criteria nominated in **Section 3**.

The results of the assessment are:

- Compliance with the annual average $PM_{2.5}$ criteria at all locations.
- Compliance with the maximum 24 hour average $PM_{2.5}$ concentration criteria at all locations except Location 7 during year 27.
- Compliance with the 24 hour average PM_{10} criterion at all locations except at Locations 6 and 7 during all modelled years and Location 1 during year 27.
- Compliance with the annual average TSP criterion at all locations.
- Compliance with the annual average deposition criterion at all locations.
- Compliance with cumulative impacts air quality environmental values.

7 GHG Regulatory Requirements

The National Greenhouse and Energy Reporting Act 2007, the Regulations under that Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008 establish the legislative framework for a national greenhouse and energy reporting system.

These Technical Guidelines embody the latest methods for estimating emissions and are based on the National Greenhouse and Energy Reporting (Measurement) Determination 2008 as amended ('the Determination') by the National Greenhouse and Energy Reporting (Measurement) Amendment Determination 2009 (No. 1). Technical Guidelines provide additional guidance and commentary to assist in estimating greenhouse gas emissions for reporting under the NGER system.

The objectives for the NGER system are set out in the National Greenhouse and Energy Reporting Act 2007 (the Act) and include:

- Informing government policy formulation and the Australian public.
- Meeting Australia's international reporting obligations.
- Assisting Commonwealth, State and Territory government programs and activities.
- Underpinning the introduction of an emissions trading scheme in the future.
- Avoiding duplication of similar reporting requirements in the States and Territories.

The Act makes reporting mandatory for corporations whose energy production, energy use, or greenhouse gas emissions meet certain specified thresholds. These thresholds are detailed in the Regulations and reproduced in the National Greenhouse and Energy Reporting Guidelines Department of Climate Change (2008b), prepared by the Department of Climate Change. Section 7.1 summarises the reporting thresholds.

The Determination was made under subsection 10 (3) of the Act and provides methods, and criteria for methods, for the estimation and measurement of the following items arising from the operation of facilities:

1. Greenhouse gas emissions.
2. The production of energy.
3. The consumption of energy.

Greenhouse gas emissions are defined in the NGER Regulation as:

> *(2) Emissions of greenhouse gas, in relation to a facility, means the release of greenhouse gas into the atmosphere as a direct result of 1 of the following:*
>
> > *(a) an activity, or series of activities (including ancillary activities) that constitute the facility (scope 1 emissions);*
> >
> > *(b) 1 or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (scope 2 emissions).*

Coverage of Scope 1 emission sources in the Determination is given by the following categories:

- Fuel combustion, which deals with emissions released from fuel combustion.
- Fugitive emissions from fuels, which deal with emissions mainly released from the extraction, production, processing and distribution of fossil fuels.
- Industrial processes emissions, which deal with emissions released from the consumption of carbonates and the use of fuels as feedstocks or as carbon reductants, and the emission of synthetic gases in particular cases.
- Waste emissions, which deal with emissions mainly released from the decomposition of organic material in landfill or wastewater handling facilities.

The most important source of Scope 1 emissions is from fuel combustion, which accounts for over 60 per cent of the emissions reported in the national greenhouse gas inventory.

Scope 2 emissions are generally emissions that results from activities that generate power offsite for consumption onsite. The largest contributor to scope 2 emissions is consumption of electricity.

7.1 Reporting Thresholds

The National Greenhouse and Energy Reporting Act 2007 sets thresholds for reporting for the operation of a facility or corporations. Section 13 of the NGER Act is as follows:

13 Thresholds

(1) A controlling corporation's group meets a threshold for a financial year if in that year:

(a) the total amount of greenhouse gases emitted from the operation of facilities under the operational control of entities that are members of the group has a carbon dioxide equivalence of:

(i) if the financial year starts on 1 July 2008—125 kilotonnes or more; or

(ii) if the financial year starts on 1 July 2009—87.5 kilotonnes or more; or

(iii) if the year is a later financial year—50 kilotonnes or more; or

(b) the total amount of energy produced from the operation of facilities under the operational control of entities that are members of the group is:

(i) if the financial year starts on 1 July 2008—500 terajoules or more; or

(ii) if the financial year starts on 1 July 2009—350 terajoules or more; or

(iii) if the year is a later financial year—200 terajoules or more; or

(c) the total amount of energy consumed from the operation of facilities under the operational control of entities that are members of the group is:

(i) if the financial year starts on 1 July 2008—500 terajoules or more; or

(ii) if the financial year starts on 1 July 2009—350 terajoules or more; or

(iii) if the year is a later financial year—200 terajoules or more; or

(d) an entity that is a member of the group has operational control of a facility the operation of which during the year causes:

(i) emission of greenhouse gases that have a carbon dioxide equivalence of 25 kilotonnes or more; or

(ii) production of energy of 100 terajoules or more; or

(iii) consumption of energy of 100 terajoules or more.

The thresholds can also be summarised as shown in Figure 7.1.

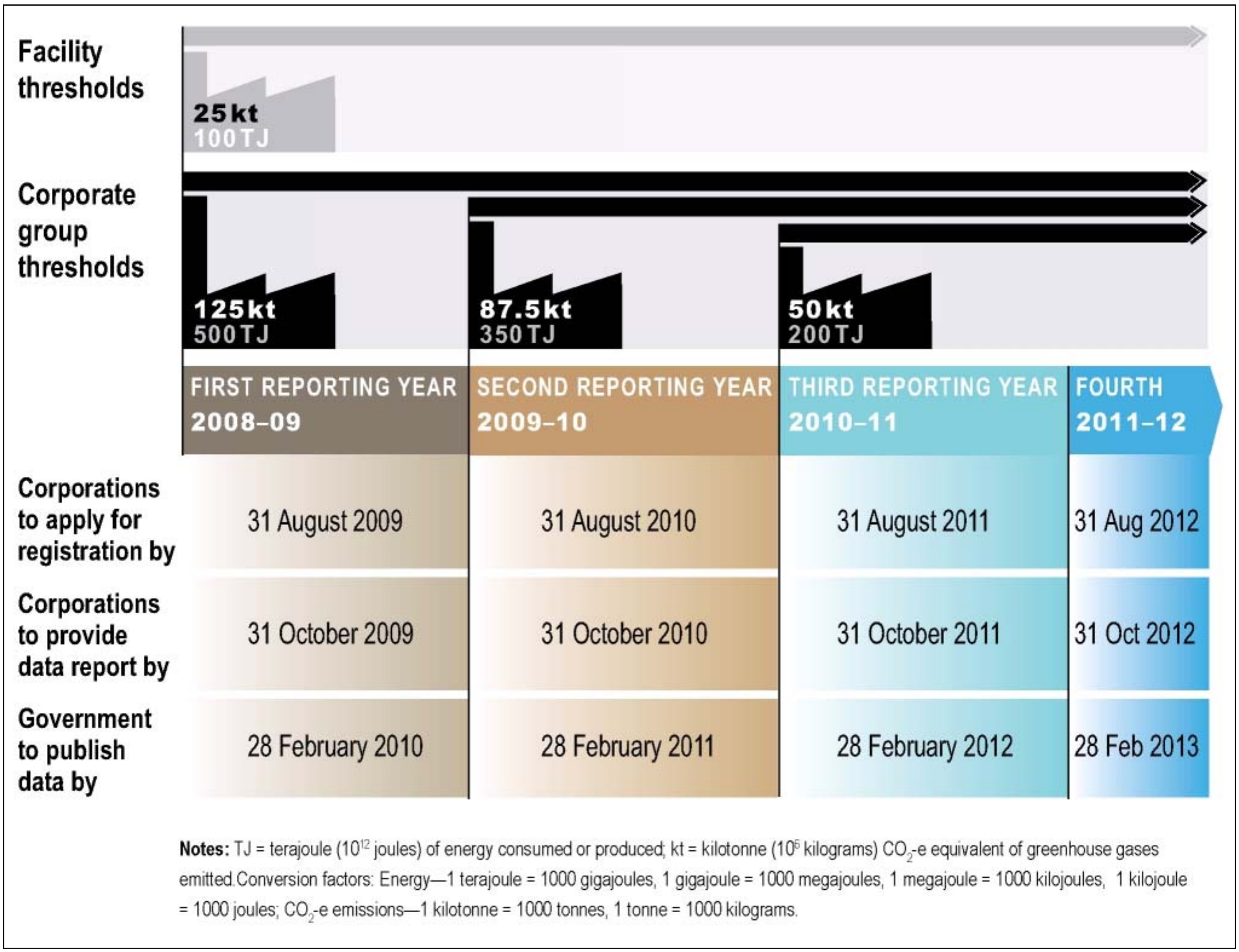

Figure 7.1 The National Greenhouse and Energy Reporting Thresholds (DCC ,2008b)

7.2 Greenhouse Gases Included

Consistent with the Kyoto Protocol and the National Greenhouse and Energy Reporting Regulations 2008 (NGER Regulation)(DCC, 2008a), minimisation of greenhouse gas emissions has concentrated on six key greenhouse gases:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Specified Hydrofluorocarbons (HFC's)
- Specified Perfluorocarbons (PFC's)
- Sulphur hexafluoride (SF_6)

These gases differ in their capacity to trap heat and contribute to the greenhouse effect. The capacity of each gas to contribute to global warming is referred to as its global warming potential (GWP) relative to that of carbon dioxide. The GWP's of the six Kyoto greenhouse gases are provided in Table 7.1.

Table 7.1 Global Warming Potential of Greenhouse Gases

Greenhouse Gas	GWP
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFC's)	140 -11,700
Perfluorocarbons (PFC's)	6,500 – 9,200
Sulphur hexafluoride (SF_6)	23,900

Because of the variation in GWP between different gases, the emission factors used to calculate greenhouse gas emissions from the Project are stated in terms of carbon dioxide equivalents (CO2-e) and consider the various GWP's of the different greenhouse gases.

8 GHG Assessment

An assessment of the greenhouse gas emissions associated with the project was conducted and involved:

- Identification of the likely sources of greenhouse gas emissions.
- Estimating the likely quantities of greenhouse gases from these sources.
- Nominating emission factors for the GHG sources.
- Identification of possible emission abatement measures.

Emissions of greenhouse gases were calculated in accordance with methods provided by the Australian Department of Climate Change formerly Australian Greenhouse Office (AGO). GHG emission estimates are based on the following:

- Operational data supplied by AustralAsian Resource Consultants.
- GHG emission factors nominated in National Greenhouse and Energy Reporting System Measurement Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia, June 2009 (DCC, 2009a).

8.1 Emission Sources

The following greenhouse gas emission sources were included in the assessment:

- Scope 1 emissions:
    - Fuel consumption by mining equipment.
    - Combustion of Ammonium Nitrate Fuel Oil (ANFO) for blasting.
    - Coal seam gas emissions.
- Scope 2 emissions:
    - Electricity purchased from the grid.

8.2 GHG and Energy Emission Factors

8.2.1 Liquid Fuel Emissions

Diesel fuel will be used by mining equipment during operations. Light vehicles and pumps as well as lighting will also consume diesel.

An estimate of annual diesel use by the plant/equipment has been supplied to ASK and is 70,598 kL for mobile equipment. Emission factors for liquid fuel consumption are shown in Table 8.1.

Table 8.1 Liquid Fuel Emission Factors

Fuel Type	Energy Content (GJ/kL)	Scope 1 Emission Factor (kg CO2-e/GJ)
Diesel (stationary)	38.6	69.5
Diesel (mobile)	38.6	69.9
Petroleum based oils (other than petroleum based oil used as fuel)	38.8	27.9
Petroleum based greases	38.8	27.9
Gasoline (other than for use as fuel in an aircraft)	34.2	67.1

8.2.2 Consumption of Electricity

Consumption of purchased electricity is to occur in order to power the development. The project Feasibility Study Report provides an estimate of the annual consumption of purchased electricity as 75,000,000 kWh.

Emission factors associated with consumption of purchased electricity are shown in Table 8.2.

Table 8.2 Consumption of Purchased Electricity Emission Factors

State, Territory or grid description	Scope 2 Emission factor (kg CO2-e/kWh)
Queensland	0.89

8.2.3 Explosive Emissions

The combustion of fossil fuels within explosives proposed to be used in the mining process will result in emissions of greenhouse gases. As the explosives are manufactured onsite emission factors are base on the consumption of material to make Ammonium Nitrate/Fuel Oil (ANFO) and Emulsion blast products. Emission factors are based on the fuel oil content of ANFO and are taken as stationary emissions from Table 8.1. Quantities of fuel oil in the manufacturing process are based on a 5.7% of ratio of fuel oil. The annual consumption of fuel oil to make ANFO would be 150.2 kL.

8.2.4 Coal Extraction Emissions

Open-pit coal extraction releases gaseous emissions. ASK had been informed that the maximum production of black coal would be 8.4 Mt per annum and calculations are based on this assumption, although this has since been adjusted down to 8.2 Mt per annum.

Emission factors associated with production of black coal are shown in Table 8.3.

Table 8.3 Coal Extraction Emission Factors

Fuel Type	Energy Content (GJ/t)	Scope 1 Emission Factor Qld (t CO2-e/t ROM Coal)
Black Coal	27.0	0.017

In addition, further greenhouse gases are associated with the energy produced from the coal, based on the energy potential of the product coal.

8.3 GHG & Energy Summary

The emission factors outlined in **Section 8.1** have been used to estimate the annual greenhouse gas emissions for the project. **Table 8.4** summarises the emissions expressed as kilo-tonnes of CO_2 equivalent and energy expressed as terajoules (TJ).

Table 8.4 Greenhouse Gas Emissions Summary

Year	Source	Type	Quantity	Scope 1			Scope 2	
				CO2-e kt	Energy Cons. TJ	Energy Prod. TJ	CO2-e kt	Energy Cons. TJ
Prod. Year	Liquid Fuel	Diesel - Mobile kL	38,968	247.3	1510.6	226,800	66.8	270
		ANFO Diesel - Stationary kL	150.2					
		Energy Consumption TJ	1510.6					
	Purchased Electricity	Qld kWh	75,000,000					
	Coal	ROM Mt	8.4					
		Energy Production TJ	226,800					
Total	CO2-e kt			314.1				
	Energy	Consumption TJ		1,780.6				
		Production TJ		226,800				

The Project as shown in **Table 8.4** is estimated to consume annual maximum energy of 1780.6 TJ. Through the extraction of coal energy production is estimated to be 226,800 TJ.

The Project is expected to generate annual maximum emissions of 314.1 kt CO_2-e (see **Table 8.4**). The annual maximum emissions represent a contribution of less than 0.173% to the reported QLD greenhouse gas emissions in 2007 (DCC, 2009b) and less than 0.06% of Australia's reported greenhouse emissions in 2008 (DCC, 2009c).

The effects of global warming and associated climate change are the cumulative effect of many thousands of such sources and it is the cumulative effects that ultimately bring about climate change.

8.4 GHG Abatement

To ensure that the emissions of greenhouse gas emissions are minimised, the following management measures should be considered:

- The inventory of emissions developed for this assessment should be regularly updated and maintained because reporting may be required, as an individual facility or as part of a corporate group.
- During procurement of both diesel and electric powered equipment, the efficiency of the equipment should be considered.
- Equipment should be maintained to retain high levels of energy efficiency.
- An internal review should be conducted annually to ensure that the mine is applying best practice techniques to minimise energy use.

9 Recommendations

From the analysis in Section 6, it is apparent that the predicted air pollutant impacts from the proposed Elimatta mine at receivers 1, 6 and 7 exceed the criteria nominated in Section 3 at various stages throughout the mine life.

A brief description of the receivers and their location relative to the relevant mining lease areas in the region are detailed below:

- 6 and 7 - Receivers are within the proposed mining lease area and will be owned by the mine and unoccupied, therefore shall not be considered sensitive receivers.
- 1 - Receiver is currently unoccupied. If the dwelling becomes occupied in future, it shall be considered in air pollutant mitigation planning.
- If a complaint relating to air pollutants is received from nearby residents as a result of mining activities, then air quality monitoring should be conducted. Care should be taken to ensure that measured levels are representative of mining operations, and are not dominated by other extraneous sources or other mining operations. Results should be reported in conjunction with weather data.
- The ROM stockpile pad should be fitted with a water sprinkler system to be used prior to loading from stockpile into the hopper.

10 Conclusions

The Elimatta Mine Project is a proposed open pit coal mine. Mining, processing and handling are proposed to be conducted 7 days a week, 24 hours a day.

The air pollutant impacts from the Project were assessed against typical DERM dust deposition guidelines and Environmental Protection (Air) Policy 2008 goals with the following results, including dust control measures as per Table 5.5:

- Compliance with TSP, PM_{10} and $PM_{2.5}$ concentration goals at all locations except for the following locations that are currently either owned by the mine and unoccupied, or are presently unoccupied and are to be managed accordingly:
  - Location 1 exceedances of the PM_{10} concentration goals.
  - Location 6 exceedances of the PM_{10} concentration goals.
  - Location 7 exceedances of the PM_{10} and 24 hour average $PM_{2.5}$ concentration goals.
- Compliance with the deposition goal at all locations.
- Air quality management recommendations have been proposed in Section 9.

A greenhouse gas assessment has been conducted for the Elimatta Mine Project in accordance with the guidelines set out by the Department of Climate Change (DCC).

The Elimatta Mine Project as shown in Table 8.4 is estimated to produce a maximum of:

- 314.1 kt CO_2-e greenhouse gas emissions per year
- Consume annual maximum energy of 1780.6 TJ
- Production of annual maximum energy of 226,800 TJ through the extraction of coal

Thresholds for reporting for an individual facility and corporate group are as follows:

- Individual Facility
  - Emissions of 25 kt CO_2-e
  - Consumption of 100 TJ
- Corporate Group
  - Emissions of 50 kt CO_2-e
  - Consumption of 200 TJ

The estimated emissions from the Project exceed both the CO_2-e and energy consumption thresholds for reporting as an individual facility. The mine alone also exceeds the reporting thresholds for a corporate group. As thresholds are exceeded, the inventory of emissions developed for this assessment should be regularly updated and maintained, because reporting would be required as an individual facility or as part of a corporate group.

Typical greenhouse gas emission abatement measures are summarised in Section 8.4.

Please contact the undersigned with any queries on 07 3255 3355.

Yours faithfully

ASK Consulting Engineers

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Air Quality Manager

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